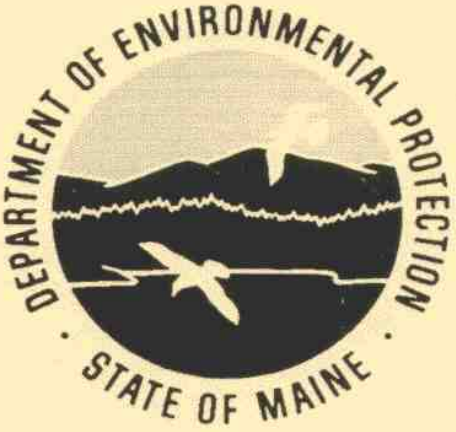
State of Maine 1997 Backyard Trash Burning (BYB) Study



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EXECUTIVE SUMMARY (remainder of study omitted)

Air quality and the health effects of pollutants have become a growing concern in the state of Maine. At the same time the number of backyard trash incinerators has also increased. Smoke from these barrels contains many pollutants that travel at ground level, exposing those downwind to potentially health-threatening compounds.

In response to public concern about these health effects, the Maine State Legislature enacted LD 967, a clarification of open burning statutes, effective August 30, 1997. The law clarified open trash burning permitting procedures and requirements, restricted what materials can and cannot be burned, and limited burning to areas with no municipal waste collection service. LD 967 also mandated that the Department of Environmental Protection (DEP) examine the magnitude and impact of backyard burning in Maine, its causes and options for reducing its impact. The DEP developed this report to address those issues.

1. The Extent of Backyard Trash Burning (BYB) in Maine

The Department of Conservation Forestry Bureau surveyed town fire wardens and state forest fire rangers about backyard burning in each town and in groups of townships in the state.

The survey identified an estimated 8,510 backyard trash incinerators in the state of Maine, or about 1 barrel for every 144 people. The burn barrel per person ratio is significantly higher in some counties than in others, ranging from a low of 1 barrel per 1000 residents in Cumberland County to a high of 24 barrels per 1000 residents in Aroostook County. The data suggests that counties and municipalities with lower populations have a greater number of burn barrels in use.

The BYB survey also asked local fire wardens *"why they think"* people in their town burn their garbage in backyard incinerators. The qualitative responses encompass economics, culture, habits and inconvenience. The results showed that no single reason outweighed the others, but rather that most communities cited a combination of factors influencing people's tendency to burn garbage.

2. The Impact of BYB Emissions

There are two general ways of assessing potential emission impacts from backyard trash burning. One way is to estimate the total annual emissions to the environment. A second way of assessing potential emission impacts is to estimate concentrations of pollutants downwind from a burn barrel for comparison with various health-based ambient air guidelines or standards. A common method for estimating downwind concentrations is by air dispersion modeling. The present analysis applied both approaches. Central to both approaches are estimates of the amount of pollutants emitted from burn barrels into the air per unit weight of trash burned, referred to as emission factors. The report includes a discussion of emission factors for various pollutants emitted by burn barrels and uses emission factors in a modeling approach to estimate localized impacts and assess the public health risk such emissions might create.

Estimates of the potential total annual emissions were generated using recently developed EPA emission factors and the Maine BYB Survey results. The *estimated total mass of waste burned in Maine BYB Barrels* is **19,147 kg per day or 21 tons per day.**

On the basis of the total emissions results, fine particulates and dioxins appear to be at potential levels of localized public health concern. As such, these pollutants have been focused on in this report and are suggested for use as indicators of

potential public health impact concerns when making risk management decisions. The estimated total annual emissions of other Hazardous Air Pollutants (HAPS) may be high enough to contribute to acute health effects but were not analyzed further due to limited resources.

On the basis of the TEQ total annual emissions estimates for dioxin/furan (7 to 23 grams per year), backyard incinerators appear to be a significant source of dioxin emissions in the state, when compared to other known sources of the pollutant such as municipal waste combustors. The analysis does estimate the total mass of dioxin/furan produced by burn barrels to be between 12,000 and 38,000 times higher than the dioxin/furan emitted by a clean-burning municipal waste combustor burning an equal amount of garbage.

The ash data also indicates cause for concern about dioxin/furan impacts (see Table 4). The ash content analysis yielded an estimated mass of ash generated by backyard burners of between 2,942,300 kg (3243 tons) and 3,732,039 kg (4113 tons) of ash produced annually with a dioxin content between 635 ppt and 2600 ppt (TEQ or toxic equivalency quotient); a concentration between 2.5 and 10.5 times higher than the state standard for maximum dioxin content in sludge that can be spread on land.

To determine whether localized pollutant emissions might be a concern for public health exposure, this study has used a modeling analysis approach to estimate the pollution impacts near a burn barrel. The EPA emission factors were used to characterize the types and concentrations of pollutants emitted. The estimated impacts were then compared to benchmarks or standards for acute and long term exposure.

Benchmarks for Comparison

Fine particulate matter (particles with diameters less than 10 micrometers) can penetrate to the deepest regions of the lung, and can accumulate in the respiratory system. Scientific studies have linked particulate matter, especially the fine particulate matter, with a series of significant health problems including premature death, respiratory related hospital admissions and emergency room visits, aggravated asthma, acute respiratory symptoms, including severe chest pain, gasping and aggravated coughing, chronic bronchitis, decreased lung function that can be experienced as shortness of breath, and work and school absences. [Reference: EPA fact sheet on Revised Particulate Matter Standards @ http:\\ttnwww.rtpnc.epa.gov/naaqsfin/pmfact.htm published July 17, 1997].

Toxicological studies for dioxin/furans have shown PCDDs and PCDFs can cause a number of deleterious effects in animals, including cancer, reproductive and development toxicity, immune system toxicity, a wasting phenomenon characterized by body weight loss, and organ toxicity. Some of these effects are manifested by long-term chronic exposures (e.g., cancer), while others can result from a single dose (e.g., immune system effects). Animal studies indicate that the most sensitive toxic effects (those occurring at the lowest exposures) are immune, reproductive and developmental effects. Importantly, these sensitive effects may result from short-term exposures.

The benchmarks of primary concern used for analysis in this study are

Federal and State Standards:

PM2.5: 65 μg/m3 24 hour National Ambient Air Quality Standard (NAAQS)

PM10: 150 μg/m3 24 hour Maine Ambient Air Quality Standard (MAAQS)

Maine Interim Ambient Air Guideline (MIAAG HAPS):

for long term exposure:

Dioxin/Furans: *3.5* x 10^{-6} µg/m3 (IAAG- Subchronic Exposure guideline)

USDHHS Agency for Toxic Substances and Disease Registry Guideline (ATSDR):

for acute exposure:

Dioxin/Furan: 8.3 x 10^{-4} µg/m3 (ASTCR - Acute exposure guideline A)

1.8 x 10^{-4} µg/m3 (MeBOH - Acute exposure guideline B)

Modeling Simulation Results

PARTICULATES—ISCST3 screening and refined modeling of various types of open burning scenarios for typical recycler and non-recycler household waste in 55-gallon barrels shows that there are potential health risks from $PM_{2.5}$ and PM_{10} emissions. Just 15 minutes of open burning results in exceedances of the 24-hour PM_{10} MAAQS and 24-hour $PM_{2.5}$ NAAQS. The highest modeled impacts were located at flagpole receptors *within a few feet* of the source of open burning especially in windy conditions at levels around 2.7 times the 24-hour PM_{10} MAAQS and 5.8 times the 24-hour $PM_{2.5}$ NAAQS.

Results show the potential for health risks *within 26 feet* of the source of open burning from just 15-minutes of $PM_{2.5}$ and PM_{10} emissions, however, if open burning occurs for many hours in a day, then the potential health risk zone would expand further from the burn barrel.

DIOXIN/FURANS—The maximum 24-hour impact contribution from just 15-minutes of open burning was 7,700 times the 24-hour dioxin/furan IAAG. However, this impact occurred at just *1 meter* downwind from the barrel, and dropped rapidly with increasing angle off the centerline. Of more interest is the observation that 15-minutes of open burning results in PCDD/PCDF impacts two (2) times the subchronic exposure guideline, at a downwind distance of *500 meters* (1640 feet); and at *100 meters* the IAAG was exceeded even at 20 degrees from the plume centerline. It should be noted, however, that the zone of potential health risks was reduced to *148 feet* of the burn barrel or less when using the lower dioxin emission factors reported for the other three test cases. Although this study focused on the potential for maximum impacts, use of an 'average' PCDD/PCDF emission factor may be appropriate when making comparisons to the subchronic exposure guideline for making risk management decisions.

Risk Assessment/Risk Management Considerations:

Are these pollutant emissions at levels of concern for public health exposure?

The modeling results need to be viewed with some caution because the way burn barrels are used by any one individual is highly variable. The modeling analysis is also faced with uncertainties as a result of the variables inherent in the emission factors used, as well as the highly variable meteorological and topographical conditions at any one site. These uncertainties can create both higher and lower predicted impacts. Because there is no good data on the frequency, volume and duration of burning from individual burn barrels, current analyses have focused on potential acute exposures and health impacts, rather than long term exposures and impacts (e.g., cancer).

There are also risk assessment uncertainties, the *acute exposure* to dioxin/furans can act as an immunosuppressant making

people more prone to become sick and less able to recuperate. It is not known what the effects of a weekly or bi-weekly exposure to such compounds could result in. Therefore, it is important to keep in mind that because of uncertainties in the toxicological studies, there may still be some level of concern for reproductive, developmental or other health impacts in the population from *subchronic exposure* impacts.

Given the modeling analysis predictions presented in this study, there appear to be scenarios under which barrel burning of trash could cause localized public health impacts. When making risk management decisions about backyard trash burning, state and local officials need to consider whether the risk is acceptable in their communities and/or whether it may be possible to burn without health impacts as long as reasonable distances are maintained from property lines and homes. The decision hinges on what level of risk people are willing to accept.

Since the dioxin/furan results appear to be at levels of most concern in the modeling analysis, it is recommended to use those impacts if/when considering a setback requirement approach. There is a strong argument for at least a 22 meter setback, based on potential acute exposure to dioxin and associated health effects. There is also some basis for a setback of 148 feet, based on modeling results using *average* emission factors for dioxin and a subchronic exposure guideline (potential for repeated exposure). Also, depending on the level of risk a community is concerned about, there is an argument for a setback of up to 500 meters, based on the subchronic exposure guideline for dioxin; which was exceeded out to 500 meters when using the *highest* dioxin emission impacts modeled in this analysis.

Keep in mind the high levels of dioxin/furan that have been found in the ash and the total mass annual emissions to the air. A survey of people practicing barrel burning in Illinois indicated that a significant number of respondents disposed of ash by spreading on gardens, piling for wind dissipation, or dumping in ditches or in the forest. Disposal in these ways may result in dioxins pervading food chains, resulting in additional routes of exposure beyond direct inhalation that can be a significant public health concern.

Total mass annual emissions to the air also look high in comparison to other known sources of the pollutant in Maine, and may warrant careful review by the Legislature as it considers ways to reduce the release of dioxins into the environment. The results from the present analysis will be used in the preparation of an inventory of dioxin sources in Maine and state and local risk management decisions may need to be revisited at that time.

Finally, in the case of backyard trash burning, the concern for public health exposure is the same for both the person who burns the trash and the neighbors who are impacted. Public health concern does not start or stop at someone’s property line. State and local officials should identify what level of risk the community is willing to accept from back yard burn barrels and at a minimum establish recommended guidelines for impact on the ‘burner’ as well as those downwind of the barrel. If burning is allowed, officials need to remain cognizant of the impact on people with asthma and other respiratory or heart disease conditions and implement "public nuisance" statutes or other more protective measures when necessary. DEP strongly urges public officials to evaluate whether the risk to their community would be better managed by using an alternative waste management strategy.

3. Maine’s Solid Waste Management & Recycling Infrastructure

In order to evaluate and recommend alternative waste management strategies to reduce backyard trash incineration, the Maine State Planning Office analyzed the existing solid waste management and recycling infrastructure in the state and the possible dis-incentives to recycle or dispose of waste properly. Maine waste management law establishes municipalities as the primary decision-makers with respect to solid waste management matters. Municipalities choose which other municipalities to cooperate with, how much commercially generated MSW they will handle directly, and what combination

of management options to use. Analysis of the warden survey and SPO data showed a strong correlation between the existence of Municipal Trash Collection Services and low burn-barrel usage.

Participation in recycling increased from 72% in 1992 to an estimated 90% in 1996. Of the 404 municipalities represented in the 1996 reporting to the State Planning Office, 48% recycled at 35% or more. Analysis of the recycling and burn barrel data, however, found no correlation between recycling rates and numbers of burn barrels.

State law and local ordinances now prohibit backyard trash burning in at least 150 communities statewide, 128 of which are subject to the state level prohibition and 20 of which are corporate members of Regional Waste Systems, Inc. and by contractual requirement have adopted backyard burning bans. A survey of town fire wardens showed that the majority would like to see backyard burning banned or restricted to extreme circumstances.

For communities where economic reasons are the motivating factors for burn barrel use, finding ways to help communities cope with these costs may be helpful. For example, the island communities often have the highest expenses for many solid wastes and recyclables to the mainland and the BYB survey results show islands with the highest burn barrel use in the state. For communities where inconvenience is the motivating factor, making waste disposal and recycling options easier to use and extending them into rural areas could contribute to reduced burning. In areas where culture and habits are the main factor in burning, extensive education campaigns about the negative effects of burning could help people want to change their habits. One approach that could help reduce municipal waste management costs would be development of a statewide source reduction strategy such as requiring a reduced packaging requirement on products sold in Maine.

4. Backyard Burning Study Group Recommendations

The DEP Bureau of Air Quality reviewed the findings of the backyard burning study and developed recommendations for legislative action.

The Study Group considered five options for potential legislation:

1) Statewide prohibition of backyard burning

2) Statewide prohibition of backyard burning with rural exemptions

3) Statewide prohibition of backyard burning with rural exemptions for overwhelming financial burden

4) Allowed rural burning with setbacks

5) Allowed burning with setbacks in any community without municipal trash collection service

The Study Group Advisors made the following recommendations:

1) Setbacks: The Study Group recommended requiring a burn barrel setback in relationship to neighboring structures or property lines. The group also recommended an "advisory" burn barrel setback distance from the burners' own homes.

2) Municipal Incentives: The Study Group recommended implementing a program to enable communities to deal with backyard burning at the local level by providing incentives, such as recycling credits, or tax credits to encourage towns to provide municipal trash collection service and develop BYB ordinances.

3) Education: The Study Group recommended implementing an educational component geared toward

younger generations and modeled after successful recycling and seatbelt education campaigns.

DEP Recommendations

The Study Group has identified an initial course of action that would have the effect of limiting public exposure to local emissions. The course of action would be implemented through the Group's proposed legislation.

DEP recommends discussion of this proposed legislation in the context of a "first step" toward an ultimate goal of eliminating the harmful health and environmental impacts of backyard burning. Additional considerations should include: (1) identifying the level of public health risk a community is willing to accept; whether setbacks or elimination would be most desirable as the risk management strategy; (2) establishing a state-wide minimum setback requirement of at least 300 feet from neighboring property lines or structures; (3) advisory setbacks from burners' own residences; (4) local incentives to reduce backyard burning and implement environmentally friendly alternative waste management strategies.

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